Volume 4 Article 24

4-1-1977

Research Notes: Soybean breeding research in India

Md. Fazlul Haque
Ranchi Agricultural College

Surendra Prasad
Ranchi Agricultural College

The fact that this is not necessarily so is evident from this model, which again has only additive and additive X additive epistasis effects in it.

References

Hanson, W. D., A. H. Probst and B. E. Caldwell. 1967. Evaluation of a population of soybean genotypes with implications for improving self-pollinated crops. Crop Sci. 7: 99-103.

Matzinger, D. F. 1963. Experimental estimates of genetic parameters and their applications in self-fertilizing plants. In Statistical Genetics and Plant Breeding, pub. 982, Natl. Acad. of Sci. - Natl. Res. Council. Hanson, W. D. and H. F. Robinson (eds.).

W. A. Compton

RANCHI AGRICULTURAL COLLEGE
Department of Plant Breeding
Kanke, Ranchi-6, India

1) Soybean breeding research in India.

Introduction: Soybean (Glycine max (L.) Merrill) is the miracle crop of the twentieth century. It is a new introduction to Indian agriculture. In view of chronic shortage of protein and oil in this country, soybean should be welcome introduction to provide the much needed stability and boost to the production of these two essential items of food (Saxena, 1975). Its high nutritive value makes it ideally suited for its versatile industrial uses. Its increasing industrial exploitation has, also, led to the manufacture of a large number of antibiotics in this country (Singh and Bajaj, 1969).

There is an immediate demand for soybean of 10,000 to 12,000 tons from the antibiotic industries of India, which utilize soybean as culture media. A demand for equal quantum is from the high protein food units. There is also a substantial demand from the poultry and animal feed industry (Jayswal, 1969).

Keeping in view the rising trend of demand for soybean from every corner of the country's economy, an overall improvement has to be undertaken in different agro-ecological conditions of India, to derive the fullest advantage from this wonder crop.

Floral biology: The knowledge of floral biology serves as a guideline to frame the various steps in proper execution of hybridization programs. The various aspects of floral biology, like bud development, time of blooming,

commencement and period of flowering, time of dehiscence of anther, viability of pollen grains and receptivity of stigma have been studied by Datta and Maiti (1966) and Lal et al. (1972).

Phenotypic and genotypic variability: Lal and Haque (1971) studied the phenotypic and genotypic variabilities in a collection of 36 varieties of soybean under rain-fed condition at the experimental farm of Ranchi Agricultural College, Kanke, in the rainy season of 1968. Heritability estimates (broad-sense) were found to be high for days to maturity, days to first flowering, period of flowering, 100-seed weight, number of leaves, number of nodes and total leaf area. They were moderate for the number of pods and low for seed yield.

Correlations among quantitative characters: Lal and Haque (1971) reported highly significant positive association of seed yield with number of leaves, total leaf area, plant height, number of nodes and number of pods. There was no significant association of seed yield with days to first flowering, days to maturity and 100-seed weight. The character 100-seed weight was negatively associated with almost all the characters studied except with period of flowering and seed yield where there was no significant correlation.

Kaw and Menon (1972) observed highly significant positive relationship of bean yield with number of beans, number of pods, days to 50% flowering, and plant height. Maturity also showed a positive association with yield.

Rohewal and Kopper (1973) reported that grain yield has positive correlation with number of branches, days to maturity, seeds per pod and 100-grain weight.

Path coefficient analysis: Lal and Haque (1971) indicated that total leaf area and plant height along with the direct yield attribute number of pods may be recommended as reliable selection indices.

Sengupta and Kataria (1971) reported that maximum weight should be given to days to maturity and leaves per plant which are directly related to the food manufacturing process of the plant.

Kaw and Menon (1972) observed that number of pods, days to maturity and days to 50% flowering are the three factors exerting the greatest influence both directly and indirectly upon the bean yield in space-planted tests under the short-day conditions of Coimbatore.

Rohewal and Kopper (1973) found that number of branches, number of grains per pod, 100-grain weight and days to maturity are more important.

Hence, for a plant breeder engaged in the improvement of soybean as regards yield, it will be necessary to lay maximum stress on these characters.

Objectives in breeding: The major breeding objectives have been high seed yield, maturity to fit the area of production, nonshattering pods, stronger stems, disease resistance and improved quality. Yield was the important consideration in all programs and chemical composition also received major consideration.

Color of seed is also an important consideration, yellow seed coats and yellow cotyledons being considered essential characteristics of a new variety.

In soybean, the pods generally burst open at maturity from both the sutures and shed seeds, resulting in considerable loss in grain yield. To overcome this difficulty, the strains reported to be nonshattering in other countries were introduced and tried under Delhi conditions. A Chinese variety, 'China Cluster', has proved to be comparatively nonshattering. It is a yellow-seeded determinate variety of medium maturity, producing pods in clusters. 'N49' from East Africa is another variety which is still more nonshattering. These varieties, however, have not proved to be high yielders. These could be utilized as useful breeding stocks in development of nonshattering varieties.

Breeding methods: Most of the existing varieties of soybean in India have been obtained through introduction.

Attempts to select suitable varieties of soybean have been continuing in various states such as Punjab, H.P., U.P., Maharastra and West Bengal for the last 25 years or so, but the selection work was based on a limited genetic material. The varieties so far cultivated in hilly areas were either small seeded, viny-types or bold seeded black and brown bushy types. In parts of M.P., a small black-seeded type locally called 'Kulth' has been popularly cultivated. A good yellow-seeded type has been selected about a decade back in Punjab and was distributed under the name 'Punjab-1' which has shown very wide adaptability.

As the soybean is a self-pollinated crop, and its flowers are very small, the success of breeding by hybridization is very limited. However, attempts are under progress by soybean breeders of India to evolve varieties by hybridization.

Choudhary (1972) reported that the 10 kr radiation treatment of gamma rays was effective in shifting the mean values in positive direction for plant

height, number of seed, 100-seed weight and seed yield in the variety 'Sepaya Black'.

Improved varieties for different agroclimatic zones: Germplasm from different parts of the world was systematically evaluated at several centers and the promising selections further tested in different parts of the country. Based on yield potential, reaction to diseases, seed quality and duration, varieties suitable for different agroclimatic zones of India have been identified (Singh and Saxena, 1975).

Northern Hill Zone: Bragg, 'Lee', 'Clark 63' and 'UPSM-19' are very promising. The last three are early maturing and take about 100-110 days. Bragg is a bit late, taking about 120 days to mature.

Northern Plain Zone: Bragg and Lee were found to be superior for northern plains and, therefore, they were released in 1969 for general cultivation. A new variety, 'Ankur' developed at Pant-Nagar was released for general cultivation in 1974. This matures in about 125-130 days.

Central Zone: Several varieties such as Ankur , 'UPSM-229', 'JS2', 'J231' and 'Davis', have been found suitable for this zone. JS2 and J231 are early, taking about 105 days. Ankur, UPSM-229 and Davis take between 110-120 days for maturity.

Southern Zone: Several varieties like 'Hardee', 'Improved Pelican', 'UPSS-69' and 'EC-39821', have been found to be promising.

Heterosis studies: Choudhary and Singh (1974) studied 17 F_1's involving eight promising soybean varieties to find out the extent and nature of heterosis. Hybrids Bragg X Clark 63 and Hardee X Punjab 1 exhibited maximum heterosis for seed yield, the values for which were 67.8 and 51.5% respectively.

Diallele analysis: Singh et al. (1974) conducted a diallele study for six quantitative characters in soybean at Punjab Agricultural University, Ludhiana, during Kharif 1972. The study revealed that complex characters, like grain yield, pods and clusters per plant, were controlled by additive and nonadditive gene action. The parent Bragg in general and the cross Bragg X 'Semmes' in particular were observed to be good and should be exploited.

Stability of varieties: Rohewal (1970) reported that the varieties Bragg and Lee showed their suitability for cultivation for high yielding environments and Improved Pelican and Punjab-1 for low yielding environments for the Northern and Central Plains. The ideal variety capable of being grown in all types of environment needs to be established.

References

Choudhary, U. 1972. Investigations on the effects of gamma irradiation in soybean. M.Sc.(Ag.) Thesis, R.A.U., Bihar.

Choudhary, D. N. and B. B. Singh. 1974. Heterosis in soybean. Indian J. Genet. 34(1): 69-74.

Datta, P. C. and R. K. Maiti. 1966. Some information for plant breeders regarding the floral biology of Glycine soja Sief and Zucc (Soybean). Indian Agriculturist 19(2): 126-136.

Jayswal, P. L. 1969. Soybean research and development. Indian Farming 19 (6): 3.

Kaw, R. and P. M. Menon. 1972. Association between yield and components in soybean. Indian J. Genet. 32(2): 276-280.

Lal, V. S. and Md. F. Haque. 1971. Path analysis of yield components of soybean. Indian J. Genet. 31(2): 357-362.

_____ and _____. 1971. Genotypic and phenotypic variability in quantitative characters in soybean (Glycine max (L.) Merrill). Indian J. Agric. Sci. 42(1): 30-33.

_____, _____ and M. A. Hassan. 1972. Floral biology of soybean. Ranchi Univ. J. Res. 1(4): 1-6.

Rohewal, S. S. 1970. Stability of some superior soybean varieties. Indian J. Genet. 30(3): 650-653.

_____ and M. N. Kopper. 1973. Association analysis of soybean. Indian J. Genet. 33(1): 96-110.

Saxena, M. C. 1975. Soybean in Indian Agriculture. Seed Tech. News 5(4): 1-2.

Sengupta, K. and A. S. Kataria. 1971. Path coefficient analysis for some characters in soybean. Indian J. Genet. 31(2): 290-295.

Singh, I. and B. S. Bajaj. 1969. Soybean and antibiotic industry. Indian Farming 19(6): 8-11.

Singh, T. P., K. B. Singh and J. S. Brar. 1974. Diallel analysis in soybean. Indian J. Genet. 34(3): 427-432.

Singh, B. B. and M. C. Saxena. 1975. Soybean varieties for different agro-climatic zones in India. Seed Tech. News. 5(4): 5-7.

Md. Fazlul Haque
Surendra Prasad